Eosinophilia Among Returning Travelers: A Practical Approach

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Abstract. Eosinophilia is not uncommon among returning travelers; however, the optimal diagnostic and therapeutic approach in travelers, as opposed to immigrants and refugees, is not clearly established. This was a retrospective case series. All returning travelers from developing countries presenting at the post-travel clinic with eosinophilia (≥ 500 cells/μL) during 1994–2006 were evaluated. Data were compared with other referrals to the post-travel clinic and with a random sample of a pre-travel clinic. Of the 955 returning travelers evaluated during the study period, 82 (8.6%) had eosinophilia, and 44 (4.4%) were diagnosed with schistosomiasis. Another 38 (4.2%) cases presented with non-schistosomal eosinophilia (NSE), among whom a definite parasitologic diagnosis was achieved in only 23.7%. However, an empiric course of albendazole led to a clinical improvement in 90% of NSE cases. Helminthic disease probably accounts for the majority of cases of post-travel eosinophilia. Empiric albendazole therapy should be offered to undiagnosed NSE patients.

INTRODUCTION

Eosinophilia (usually defined as absolute eosinophil count ≥ 500 cells/μL) can arise from an extensive number of medical conditions, including allergic disorders, hematologic, and other neoplastic diseases and infections, particularly helminthic. However, the relative importance of these conditions is probably different among travelers returning from developing countries as opposed to other patients. Although eosinophilia is not rare among returning travelers, an optimal diagnostic and therapeutic approach is not clearly established. Previous studies on eosinophilia have often included immigrants, refugees, or long-term expatriates and the applicability of their results to travel is unknown.

Schistosomiasis is an important cause of eosinophilia among travelers returning from tropical countries. Its diagnosis is straightforward, because the disease is strongly associated with specific activities (i.e., exposure to infected waters), and highly sensitive and specific serologic tests are available. The relative importance of other diagnoses and the best clinical approach to cases of eosinophilia when schistosomiasis is excluded have not been established. Our aim in this study was to describe our experience with returning travelers presenting with eosinophilia and to highlight the approach to cases of eosinophilia in which schistosomiasis was excluded.

MATERIALS AND METHODS

Study design. This was a retrospective case series. Travelers (including expatriates) returning from developing countries and presenting to the Center for Geographic Medicine and Tropical Disease at the Sheba Medical Center from January 1994 to June of 2006 were evaluated. Eosinophilia was defined as total eosinophil count > 500/μL or a percentage of > 6% of total leukocyte count. Immigrants from developing countries were excluded. As a basic evaluation, all patients had a complete blood count and chemistry panel (including liver function tests) performed and submitted at least one stool sample for ova/parasites. Patients with a history of travel to schistosomiasis-endemic areas were tested for Schistosoma ova in the urine as well, and a serologic test for Schistosoma was performed, as described in detail elsewhere. In other cases, serologic tests for several helminthic infections (strongyloidiasis, toxocariasis) were performed according to the physicians’ discretion. These serologic tests, however, are not available in Israel and were performed at the Laboratory for Parasitic Diseases at the Centers of Disease Control (CDC), Atlanta, GA. Other diagnostic procedures, including imaging studies or tissue biopsy, were done according to clinical judgment. Throughout the study period, all patients diagnosed with schistosomiasis were treated with praziquantel 60 mg/kg for 1 day divided into two doses (in cases of acute schistosomiasis, the dose was repeated after 3 months). Other cases with eosinophilia were offered treatment with albendazole 400 mg twice a day for 3–5 days. Response to albendazole was evaluated according to symptoms and eosinophil count.

The study was approved by the Institutional Review Board at the Sheba Medical Center; a requirement for informed consent was waived.

Statistical analysis. Fisher exact test and Student t test were used to analyze categorical and continuous variables, respectively.

RESULTS

During the study period, 995 patients were evaluated at the post-travel clinic, of whom 82 (8.6%) had eosinophilia; 44 (53.7%) patients were diagnosed with schistosomiasis-associated eosinophilia (SAE) and another 38 (46.3%) cases presented with post-travel non-schistosomal eosinophilia (NSE). These represented 4.6% and 4% of all referrals to the post-travel clinic, respectively.

Demographic data. Age, travel duration, and male/female ratio were not significantly different between NSE and SAE cases, as detailed in Table 1.

Geographical data. SAE cases were almost exclusively acquired through travel to Africa (95%), whereas most NSE cases had traveled to Asia (65.7%), with Southeast Asia and the Indian Subcontinent as the dominant regions (Table 1).

Clinical data. Twenty-one of 44 (47.7%) SAE cases presented with acute schistosomiasis with fever, rash, and respiratory symptoms dominating the clinical picture (Figure 1);
16/44 (36.6%) were diagnosed through screening of asymptomatic fellow travelers of a diagnosed index case; and only 7 (16.9%) cases presented with chronic, usually genitourinary, schistosomiasis. The clinical and laboratory findings of these cases are described in detail as part of a nationwide report of schistosomiasis cases in Israel. 

Of the 38 NSE cases, 36 (94.7%) were symptomatic at presentation. The other two cases were referred because of eosinophilia in a routine blood test but also reported a history of previous gastrointestinal symptoms that resolved spontaneously.

Among the 36 symptomatic cases, the leading symptoms were gastrointestinal (52.6%), mainly abdominal pain and protracted diarrhea, followed by dermatologic (e.g., rash or pruritus) and respiratory symptoms (mainly dry cough). These symptoms occurred either as an isolated symptom or in combination (Figure 1). In two cases, fatigue/malaise were the only symptoms present.

In most cases, symptoms began during travel and were already present for several weeks on presentation to our clinic. The median time from the travelers’ return to presentation at our clinic was 6 weeks, ranging from 1 day to > 1 year (interquartile range [IQR], 3–9.5 weeks). These patients were generally healthy, but two cases (5.3%) had a history of asthma and atopy.

Laboratory studies and diagnosis. The median eosinophil count on first evaluation was 1,700 cells/µL (IQR, 800–2,900 cells/µL) for NSE cases compared with 1,400 cells/µL (IQR, 900–3,500 cells/µL) in SAE cases (P = 0.067). Other standard laboratory tests were generally non-contributory; mildly abnormal liver function tests were present in 5.3% of NSE cases and in 13.6% of SAE cases—a difference that was not statistically significant.

The diagnosis of schistosomiasis was made by serologic tests in all 44 SAE cases. A parasitologic diagnosis by ova was made in 22.7% of cases.

A stool sample for ova and parasites was available for 30 NSE cases, but only in 3 cases (10%) were there diagnostic findings: in 2 cases, hookworm alone was found, and in 1 case, there was a mixed hookworm and Ascaris infection. Protozoa, including Blastocystis hominis and Entamoeba histolytica/dispar, were found alone or along with helminths in four cases, but these organisms were not deemed explanatory of the eosinophilia. One patient was found to have hookworms in a sputum sample (as described in detail elsewhere). Serologic tests for Strongyloides and/or Toxocara, Filaria,
or Trichinella were performed in 11 cases. Five serologic tests for Strongyloides were positive, and the rest were negative.

Before referral to our institute, a variety of ancillary tests were performed in 18 NSE cases (47.4%). These included multiple imaging studies, including eight chest radiographs, six computerized tomographies of the chest/abdomen, and four abdominal ultrasound examinations; none of the imaging studies suggested a specific diagnosis. Ten cases had undergone biopsies: six by upper or lower gastrointestinal endoscopy, three by skin biopsies, and one by lymph node biopsy. However, in only two of these cases were these procedures contributory to a specific diagnosis.

Finally, a definite parasitologic diagnosis was achieved in only 9 NSE cases (23.7%). Another four cases were diagnosed with a probable parasitic infection: three with clinical findings of human hookworm infection (a typical papular pruritic rash; Figure 2) and one with eosinophilic colitis. It should be noted that most serodiagnoses were established a considerable time after the patient was treated at our clinic. Table 2 lists all parasitologic diagnoses in NSE cases.

Two patients were diagnosed with non-infectious disorders as a cause for eosinophilia. One patient was diagnosed as suffering from drug allergy. The other patient was initially considered to be suffering from a probable helminthic infection and indeed was later found to be seropositive for strongyloidiasis. Although eosinophilia resolved after therapy, symptoms did not improve, with increasing lymphadenopathy. A lymph node biopsy showed T cell–rich B-cell lymphoma.

Anthelminthic therapy. All patients with SAE were treated with praziquantel. Although in symptomatic cases of acute schistosomiasis the benefit of this treatment was limited, a repeated dose 3 months after exposure was administered with no cases of parasitologic failure.

Thirty-seven NSE patients were offered empiric therapy with albendazole. In general, patients were given a course of albendazole 400 mg twice a day for 5 days. Patients with a typical rash of hookworm infection were treated for 3 days. Two cases were treated with a longer course of albendazole.

Of the 37 cases, 1 declined treatment, and another 4 were lost to follow-up. Because two other cases were asymptomatic at presentation, 30 cases were evaluated for clinical response. A favorable clinical response was reported in 27/30 (90%): 76.7% with a complete remission of symptoms and another 13.3% with significant improvement. In three cases (10%), there was no response: in the first case, despite a serologic diagnosis of strongyloidiasis, the patient was further evaluated and diagnosed with lymphoma as described above, and in the remaining two cases there was no definite parasitic diagno-

<table>
<thead>
<tr>
<th>Feature</th>
<th>Current series (N = 38)</th>
<th>Whetham and others2 (N = 174)</th>
<th>Schulte and others3 (N = 648)</th>
<th>Harries and others11 (N = 114)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of all referrals</td>
<td>3.8</td>
<td>4.5</td>
<td>2.6</td>
<td>NR</td>
</tr>
<tr>
<td>Destination (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Africa</td>
<td>7.9</td>
<td>47.7</td>
<td>45.5</td>
<td>64.0</td>
</tr>
<tr>
<td>Asia</td>
<td>62.8</td>
<td>36.6</td>
<td>28.9</td>
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</tr>
<tr>
<td>America</td>
<td>26.3</td>
<td>16.5</td>
<td>7.0</td>
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</tr>
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<td>Other</td>
<td>7.9</td>
<td>52.3</td>
<td>7.1</td>
<td></td>
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<tr>
<td>Any diagnosis established (%)</td>
<td>36.8</td>
<td>78</td>
<td>36</td>
<td>46.5</td>
</tr>
<tr>
<td>A helminthic diagnosis established (%)</td>
<td>34.2</td>
<td>45.4</td>
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<td>42.1</td>
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<td>Atopic disease (%)</td>
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<td>13.4</td>
<td>3.2</td>
<td>4.2</td>
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<td>Other non-infectious diagnoses (%)</td>
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<td>1.1</td>
<td>18.2</td>
<td></td>
</tr>
<tr>
<td>Number of detected helminths</td>
<td>14</td>
<td>123</td>
<td>89</td>
<td>46</td>
</tr>
<tr>
<td>Specific helminths</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongyloides</td>
<td>5 (35.7%)</td>
<td>66 (53.6%)</td>
<td>15 (16.8%)</td>
<td>6 (13%)</td>
</tr>
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<td>Hookworm</td>
<td>7 (50%)</td>
<td>18 (20.2%)</td>
<td>9 (19.6%)</td>
<td></td>
</tr>
<tr>
<td>Ascarasis</td>
<td>1 (7.1%)</td>
<td>24 (19.5%)</td>
<td>7 (7.9%)</td>
<td>3 (6.5%)</td>
</tr>
<tr>
<td>Cutaneous larva migrans</td>
<td>–</td>
<td>1 (0.8%)</td>
<td>17 (19.1%)</td>
<td>1 (2.2%)</td>
</tr>
<tr>
<td>Filariasis</td>
<td>–</td>
<td>23 (18.7%)</td>
<td>13 (14.6%)</td>
<td>19 (41.0%)</td>
</tr>
<tr>
<td>Other*</td>
<td>1 (7.1%)</td>
<td>9 (7.3%)</td>
<td>19 (21.3%)</td>
<td>7 (17.4%)</td>
</tr>
</tbody>
</table>

* Other helminthic diseases reported: Gnathostoma, Echinococcus, Antakia, Toscocca, Enterobius, Taenia, Fasciola, Heterophysis, Hymenolepis, and eosinophilic gastroenteritis. NR = not reported.
 sis—one was diagnosed with eosinophilic gastroenteritis and the other remained without a specific diagnosis. Both cases recovered after the addition of corticosteroid treatment.

The eosinophil count was evaluated within 2 months after albendazole treatment in 29/36 (77.8%) NSE cases and showed a significant decrease in 25/28 (85.7%) cases, from a median of 2,300 cells/μL before treatment to 400 cells/μL after treatment (IQR, 1,200–3,700 and 300–700 cells/μL, respectively). As can be seen in Figure 3, the decrease in the eosinophil count after empiric albendazole was similar to that achieved after praziquantel therapy for SAE.

**DISCUSSION**

The differential diagnosis of eosinophilia is extensive. In industrialized countries, multiple medical conditions need to be considered, among them a variety of malignant, atopic, inflammatory, and endocrine conditions. However, in developing countries, infectious diseases account for the majority of cases of eosinophilia. Because most travelers to developing countries are young and generally healthy and are exposed to the living conditions there, infectious diseases should be at the top of the differential diagnosis list.

By far, the infectious diseases with the strongest association with eosinophilia are helminthic. Other infectious disorders may be associated with eosinophilia (including *Coccidioides*, *Aspergillus, Isospora belli*, *Dientamoeba fragilis*, *Mycobacterium leprae*, chronic *Mycobacterium tuberculosis*), although the data supporting the association is in some cases inconclusive. For example, in developing countries, many patients with tuberculosis or isosporiasis and eosinophilia are actually found to be co-infected with helminthes.

Schistosomiasis is an important and frequent cause of eosinophilia in travelers. If suspected, a diagnosis can easily be made by serology and less frequently by ova detection, and therapy with praziquantel is well established. However, the approach to NSE is less established and therefore presents a significantly greater diagnostic and therapeutic challenge.

Our results show that NSE is not rare among travelers, representing 4% of all referrals to the post-travel clinic in our series. Similar numbers were seen in other reports (Table 2). The prevalence of NSE in our post-travel population is not far from that reported in some local populations. For example, the incidence of eosinophilia (regardless of symptoms) in actively screened asymptomatic newly arrived refugees is reported at 12%, with 5.2% due to causes other than schistosomiasis. Indeed, some forms of travel may pose an even higher risk. For instance, in military personnel actively screened after deployment to a developing country, the incidence of NSE was 50.

NSE occurs in travelers to most destinations (Table 1). In our series, it was found more frequently in travelers to Asia, a destination that is favored by Israeli travelers, and was less common in travelers to Africa. Other series have shown higher rates in travelers returning from Africa. This may simply reflect the different preferred travel destinations in various countries.

Most cases of NSE in our series were symptomatic, but this probably reflects a selection bias inherent to a post-travel clinic setting. Other series have also found the majority of cases of post-travel eosinophilia to be symptomatic as well. On the other hand, many cases of SAE are asymptomatic at diagnosis, because in many cases, screening of fellow travelers of an index case is performed.

The diagnostic yield achieved in our series is relatively low. A definite helminthic diagnosis was made in only 23.4% of cases. Both higher and lower numbers were found by other investigators (Table 2). Some of the difference may be caused by different traveler populations: other series did not exclude immigrants and refugees, which are more likely to harbor helminths and have a higher egg burden. In addition, the use of diagnostic techniques (e.g., serology) varied and may explain some of the difference. However, Libman and others found a parasitologic diagnosis that explained eosinophilia in only 14% of cases, despite the use of serologic testing and skin/mucosal biopsies.

An important caveat is that not all diagnoses achieved through the clinical/laboratory evaluation truly explain the eosinophilia. For example, Schulte and others reported a diagnostic yield of 36%. However, these diagnoses included conditions that are not usually associated with eosinophilia such as malaria, dengue fever, *Salmonella*, etc.

The low diagnostic yield can be attributed to several causes. Many travelers are evaluated relatively early after symptom onset, whereas the time to patency (the appearance of ova in stool) for some helminths is measured in months (Table 3). The yield of routine stool examination for ova is known to be inadequate because of a low burden of infection in travelers, even when serial samples are evaluated. Sensitive serologic tests for many pathogens are not available at all, whereas to some, the tests are not commercially available. For example, the relatively high yield reported by Whetham and others is attributed largely to the extensive use of both serology and targeted stool analysis for *Strongyloides*, an organism that is notoriously difficult to diagnose through stool microscopy.

Hookworms accounted for one third of all diagnoses in our series. Among them, a clinical diagnosis of human hookworm infection was made in three cases, based on a typical papular, intensely pruritic non-creeping eruption (Figure 2) and dry cough. However, these symptoms appear in the pre-patent period, where the chance to detect ova is nil, and a serologic test is not available for this parasite. This lack of a serologic...
**Table 3**

Helminthic infections causing eosinophilia in travelers

<table>
<thead>
<tr>
<th>Name</th>
<th>Mode of transmission</th>
<th>World distribution</th>
<th>Diagnosis</th>
<th>Time to patency</th>
<th>Stool*</th>
<th>Serology*</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequently described pathogens with frequent eosinophilia</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Ascaris lumbricoides</td>
<td>Geo-helminth</td>
<td>Cosmopolitan, mostly tropical, subtropical</td>
<td>2 months + −</td>
<td>Albendazole, mebendazole, ivermectin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human hookworm spp.</td>
<td>Geo-helminth</td>
<td>Cosmopolitan, mostly tropical, subtropical</td>
<td>5–6 weeks + −</td>
<td>Albendazole, mebendazole</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongyloides stercoralis</td>
<td>Geo-helminth</td>
<td>Cosmopolitan, mostly tropical, subtropical</td>
<td>4 weeks ± +</td>
<td>Albendazole, ivermectin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schistosoma spp.</td>
<td>Aquatic</td>
<td>Africa &gt;&gt; South America, Asia</td>
<td>4–6 weeks + (urine) +</td>
<td>Praziquantel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Frequently described pathogens with infrequent eosinophilia</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Trichuris trichiura</td>
<td>Geo-helminth</td>
<td>Cosmopolitan, mostly tropical, subtropical</td>
<td>3 months + −</td>
<td>Albendazole, mebendazole</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zoonotic hookworms, (cutaneous larva migrans)</td>
<td>Geo-helminth</td>
<td>Cosmopolitan, mostly tropical, subtropical</td>
<td>Never − −</td>
<td>Albendazole, mebendazole</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rarely described pathogens with frequent eosinophilia</strong></td>
<td></td>
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</tr>
<tr>
<td>Lymphatic filariasis</td>
<td>Mosquito bite</td>
<td>Africa &gt;&gt; Asia, South America</td>
<td>3–8 months − +</td>
<td>Ivermectin, albendazole, doxycycline, DEC</td>
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<tr>
<td>Loa loa</td>
<td>Chrysops flies</td>
<td>West/central Africa</td>
<td>5 months − +</td>
<td>Ivermectin, doxycycline, DEC</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Onchocerca volvulus</td>
<td>Blackfly bite</td>
<td>Africa</td>
<td>− − − +</td>
<td>Ivermectin</td>
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<tr>
<td>Taenia solium/saginata (Taeniasis)</td>
<td>Food borne</td>
<td>Cosmopolitan</td>
<td>2 months + ±</td>
<td>Praziquantel</td>
<td></td>
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<tr>
<td>Taenia solium (cysticercosis)</td>
<td>Food borne</td>
<td>Cosmopolitan</td>
<td>2 months ± +</td>
<td>Albendazole</td>
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<tr>
<td>Trichinella spp.</td>
<td>Food borne</td>
<td>Cosmopolitan</td>
<td>Never − −</td>
<td>Albendazole (if early)</td>
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<td>Paragonimus (lung flukes)</td>
<td>Food borne</td>
<td>Asia, Latin America</td>
<td>10–12 weeks + (sputum) +</td>
<td>Praziquantel</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Gnathostoma spinigerum</td>
<td>Food borne</td>
<td>Southeast Asia, Latin America</td>
<td>Never − −</td>
<td>Albendazole</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Ancylostoma caninum- Eosinophilic gastroenteritis</td>
<td>Geo-helminth, Fecal-oral</td>
<td>Cosmopolitan, mostly tropical, subtropical</td>
<td>Never − −</td>
<td>Experimental</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

* +, available; −, not available; ±, available, but infrequently positive.

DEC = diethylcarbamazine.
test in our view probably contributes to the overall poor diagnostic yield.

It is important to note a caveat in the serologic diagnosis of many helminthic infections: the inability to differentiate between a current and a past infection. Furthermore, the sensitivity and specificity of many tests is not optimal. Cross-reactivity between several helminthic infections occurs and can lead to a possible misdiagnosis. In addition, some helminthic infections are known to be prevalent, even in developed countries, such as *Toxocara* (in France and Spain, reported rates reach 22–28%).17,18 This may further decrease the validity of a seropositive test. Ideally, a panel of stool antigenic
or nucleic acid assays for multiple helmiths would resolve these issues, but such an assay is not yet available.

How extensively should the non-infectious causes of eosinophilia be excluded in returning travelers when a stool sample is negative? Many of our patients were exposed to the risks of invasive procedures and biopsies, and radiation from imaging, but with little result. In fact, there are case reports of fatal strongyloidiasis, where eosinophilia was attributed to various reasons, such as neoplasm, dialysis treatment, or idiopathic eosinophilic pneumonia. In these cases, the travel history was considered only in hindsight.19–21

What are the probable culprits of NSE, when a stool sample is negative? We believe a few organisms may explain the majority of cases, and these should be the focus of future prospective studies. Special consideration should be given to geohelminthic infections, especially hookworms and Strongyloides.

In refugees arriving from Southeast Asia (a major source of NSE in Israeli travelers), hookworms and Strongyloides were found to be the most prevalent helminthic infections,27 and Strongyloides seroprevalence in some groups reached 77%.22 In a study by Harries and others23 both organisms accounted for about one half the parasitologic diagnoses in travelers to Asia and America. Similar numbers were reported by Whetham and others24 for travelers to regions other than Africa, among whom Strongyloides serology had the highest yield of all diagnostic procedures.

In addition to the likelihood of human hookworms causing a significant portion of undiagnosed cases of NSE, canine hookworms have recently been shown to occasionally cause a clinically indistinguishable syndrome, as well as eosinophilic gastroenteritis.25 Because canine hookworms are never patent in the stool, the only means for diagnosis is through serology for Ancylostoma caninum, which again is not yet commercially available.

Having these data in hand, what should be the management of cases of NSE? We believe empiric therapy should take precedence to extensive diagnostic efforts and propose an algorithmic approach, as shown in Figure 4. Albendazole is a broad-spectrum anthelminthic and is effective against human (and canine) hookworms, many other intestinal helminths such as Ascaris lumbricoides and Trichuris trichiura, and protozoa that are frequently encountered in returning travelers, such as Giardia lamblia. In fact, it covers the common helminthic infections that travelers are likely to encounter (Table 3). Although it is less effective than ivermectin for Strongyloides stercoralis, a cure rate of 45–78% is achieved even in endemic populations.25,26 Its safety record is excellent, its cost is low, and it therefore figures prominently on the WHO Essential Drugs List.

In populations with a high incidence of helminthic infection such as refugees and immigrants, it has been shown both in the United States and in Israel that universal treatment with albendazole is highly effective.27,28 It has been shown to be the most cost effective approach as well.29 Our study shows that, in travelers with NSE, albendazole is highly effective as well, ameliorating both symptoms and eosinophilia.

Two infections that will not be addressed by this approach are schistosomiasis (and other flukes) and (to some extent) filariasis. The major area of risk for acquiring both infections is Africa. Filariasis has only rarely been described in travelers that are not expatriates or returning immigrants. On the other hand, schistosomiasis is not rare in travelers returning from endemic regions.2–4,15,23 When these conditions cannot be clearly ruled out on epidemiologic grounds, their presence should be pursued with specific laboratory studies. Otherwise, most travelers with NSE will probably benefit from a limited evaluation, using a thorough history and physical examination, with stool samples for parasites followed by a therapeutic trial of albendazole.

An exception to this rule might be Strongyloides infection, because not all patients will respond to albendazole treatment. Therefore, our algorithm (Figure 4) recommends that if Strongyloides serology is available, it should be part of the early evaluation, and treatment with ivermectin should be given accordingly.

More tests, including serologies, imaging studies, and invasive procedures, should be reserved for cases with no symptomatic relief and laboratory improvement within 1 month after treatment when no diagnosis was achieved. Such an approach may help avoid situations where hookworm infection is finally diagnosed by video capsule after no less than three endoscopic procedures.30 In fact, several of our patients were seen by many physicians who did not consider parasitic infection, with continued suffering for several months, which ended after a short course of albendazole.

In returning travelers, eosinophilia that is not associated with schistosomiasis is not rare. Unlike local populations, travelers with NSE are often symptomatic. Most cases are probably associated with helminthic infection. The overall diagnostic yield and especially that of stool examination are low, and in most cases, a specific diagnosis is not reached. There is a clear need for a broader “battery” of serologic/antigenic/nucleic acid tests for the evaluation of patients with eosinophilia. The extensive differential diagnosis of eosinophilia is largely irrelevant in this situation, but many patients undergo needless diagnostic efforts including invasive procedures. Empiric albendazole will lead to a resolution of both symptoms and eosinophilia in most cases. Further evaluation should be reserved for those few cases who do not respond to empiric treatment.

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